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SYNTAXONOMY OF SUBALPINE TALL-GRASS COMMUNITIES (*CALAMAGROSTIETALIA VILLOSAE*) IN THE UKRAINIAN DISTRICTS OF THE EASTERN CARPATHIANS

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Abstract –This paper presents a phytosociological survey of subalpine tall-grass communities within the order *Calamagrostietalia villosae* (class *Mulgedio-Aconitetea*) in the Ukrainian districts of the Eastern Carpathians. This syntaxonomical revision includes relevés from the mountain ranges Beskydy, Gorgany, Chornohora, Svydovets', Marmarosh, Hryniava, and Chyvchyny. The analysis was performed using numerical classification methods. Five associations within three alliances were distinguished and concisely characterized. Typification and name inversion of the association *Hyperico alpigeni-Calamagrostietum villosae* Pawłowski et Walas 1949 *nom. invers. propos.* was performed.

Keywords: subalpine, tall-grass, *Calamagrostietalia villosae*, *Mulgedio-Aconitetea*, syntaxonomy, Carpathians, Ukraine

Introduction

The summit vegetation has been unevenly described in the different parts of the Carpathians. While for the Western Carpathians detailed surveys are available (Kliment & Valachovič, 2007; Kliment et al., 2010), data from the Eastern Carpathians seem to be still unstructured (Coldea, 1991; Malynovski & Kricsfalusy, 2002). Some local associations were described but contrasting classification schemes were developed for different parts of the Eastern Carpathians. See for Bukovské vrchi in Slovakia (Hadač et al., 1988), for Bieszczady in Poland (Winnicki, 1999), for the Ukrainian Carpathians (Malynovski et al., 1992; Malynovski & Kricsfalusy, 2000; 2002), and for the Romanian Eastern Carpathians (Coldea, 1991, Sanda et al., 1997; 2008).

Subalpine tall-grass and tall-forbs communities of the class *Mulgedio-Aconitetea* has been studied in the Ukrainian Carpathians since the 1930s by Czech (Domin, 1930; Deyl, 1940), Polish (Swederski & Szafran, 1931; Pawłowski & Walas, 1949), Slovak (Hadač et al., 1995), and Ukrainian researchers (Malynovski, 1980; Malynovski et al., 1992; Malynovski & Tsaryk, 1995; Malynovski & Kricsfalusy, 2000; 2002; Solomakha et al., 2004; Klimuk et al., 2006; Iakushenko, 2007). Nevertheless, these communities in the region were poorly documented so far. Moreover, data from the Ukrainian part of the Eastern Carpathians were unknown for a wide range of researches and only minimally included into large-scale reviews (cf. Michl et al., 2010). The syntaxonomical status of these communities remained ambiguous.

The aim of this paper is to describe the diversity of *Calamagrostietalia villosae* communities in the Ukrainian part of the Eastern Carpathians, and to revisit the nomenclature of already established syntaxa and to propose a new comprehensive syntaxonomical scheme for communities in this area.

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MATERIALS AND METHODS

The study area is a part of the Eastern Carpathians located within the borders of Ukraine (Fig. 1). It consists of low and gently sloping mountain ranges running in a northwest-southeast direction. The highest mountain group is the Chornohora with Hoverla as highest peak (2061 m a.s.l.). The other ridges with subalpine vegetation are Marmarosh (Mt Pip Ivan Marmaros'kyj, 1936 m), Svydovets' (Mt Velyka Blyznytsia, 1883 m), Gorgany (Mt Velyka Syvulia, 1836 m), Chyvchyny (Mt Chyvchyn, 1769 m), Borzhava (Mt Stij, 1677 m), Hryniava (Mt Baba-Liudova, 1590 m), and Eastern Beskydy (Mt Pikuj, 1405 m). The bedrock mostly consists of Carpathian flysch, except the volcanic Vyhorlat-Guta ridge and the crystalline Marmarosh mountain range. The climate is temperate continental with a cool and relatively moist (430-950 mm) vegetative season and a moderate dry (260-580 mm) winter with frequent thaws. A subalpine vegetation type ("polonyny") dominates in the Ukrainian Carpathians from 1200 to 1800 m a.s.l. (Malinovsky, 1980; 2003; Malinovsky & Kricsfalusy, 2000).

Figure 1. Location of the studying area within Europe.

The nomenclature of vascular plants follows "*Flora Europaea*" (Tutin et al., 1968 – 1980). Subspecies and varieties were merged at species level. However, for cryptogams (mosses and lichens), we used also entries that were identified only at the rank of genera.

The syntaxonomical revision was performed including original data, sampled 2005 to 2010 and data published between 1934 and 1955. The phytosociological relevé sampling followed the Braun-Blanquet approach (Westhoff & van der Maarel, 1973). A data set of 149 relevés was used for the analysis after removal of published relevés without information about mosses and lichens.

The relevés were stored in the TURBOVEG database (Hennekens & Schaminée, 2001) and classified by TWINSPAN protocol (Hill, 1979) using JUICE 6.5 software package (Tichý, 2002). Diagnostic species were chosen on the basis of fidelity measure (Chytrý et al., 2002) with corrections based on literature data. The threshold value for a species considered as diagnostic was set at a Phi coefficient (multiplied by 100) more than 30. Species that were recorded in at least 61 % of the relevés of an association were considered constant for it. The classification follows the results of previous syntaxonomical revisions of the class *Mulgedio-Aconitetea* within Europe (Michl et al., 2010) and Western Carpathians (Kočí, 2001; 2007; Kliment & Jarolímek, 2003; Matuszkiewicz, 2006; Kliment & Valachovič, 2007; Šibíková et al., 2008; Kliment et al., 2010). In the diagnoses of the communities, the following abbreviations were used: art. – article of the International Code of Phytocoenological Nomenclature (ICPN) (Weber et al., 2000), dom. – dominating species, opt. – optimal conditions, p. p. – pro parte (partially), syn. – synonym, syntax. syn. – syntaxonomical synonym, rel. – relevé. The diagnostic and constant species were arranged alphabetically.

RESULTS

Five distinct groups of relevés were obtained and their syntaxonomical ranking has been assessed. Five associations has therefore been assigned to the three following alliances: *Festucion carpaticae* (carbonatophilous chionophilous tall-grass communities), *Calamagrostion arundinaceae* (species-rich tall-grass communities of relatively warm and dry sites), and *Calamagrostion villosae* (mesophilous chionophilous tall-grass meadows on acid silicate bedrock).

MULGEDIO-ACONITETEA HADAČ ET KLIKA IN KLIKA ET HADAČ 1944

High-altitude tall-herb and tall-grass vegetation.

***Calamagrostietalia villosae* Pawłowski et al. 1928**
Tall-grass mesophilous acidophilous to basiphilous vegetation of subalpine meadows.

***Festucion carpaticae* Bělohlávková et Fišerová 1989**
Chionophilous tall-grass communities on moist carbonate soils in montane and subalpine belts.

***Festucetum carpaticae* Domin 1925**
Species-rich chionophilous tall-grass communities dominated by the Carpathian endemic *Festuca carpatica* of montane and

subalpine belts (1450–1780 m) on moist, well drained neutrophilous or slightly basiphilous skeleton-rich carbonate soils, on steep (from 10–20º to 40–55º) sheltered slopes, glens and stabilyzed calcareos screes.

Syn.: *Carduo kerneri-Festucetum carpaticae* (Puşcaru et al. 1956) Coldea (1986) 1990 (syntax. syn.), *Festucetum carpaticae* (Domin 1925) Pawłowski et Stecki 1926 (syntax. syn.).

Incl.: *Thymo-Festucetum amethystinae festucetosum carpaticae* Kricsfalusy et Malynovski 2000, p.p.

Nomenclatural type: Domin, 1925: 8, rel. 3, lectotypus (Unar et al., 1985: 39).

Diagnostic taxa: *Aquilegia nigricans, Bupleurum longifolium, Astrantia major, Cirsium erisithales, Cortusa matthioli, Euphrasia picta, Festuca carpatica* (dom., opt.)*, Galium anisophyllon, Linum catharticum, Listera ovata, Lotus corniculatus, Primula elatior, Ranunculus oreophilus, Rhinanthus alpinus, Saxifraga paniculata, Scabiosa columbaria, Thymus pulcherrimus, Veronica urticifolia* (Table 1).

Constant taxa: *Astrantia major, Calamagrostis villosa, Cirsium erisithales, Euphrasia picta, Festuca carpatica, Gymnadenia conopsea, Primula elatior.*

Distribution in the Ukrainian Carpathians: Svydovets', Chyvchyny Mts (Chorny Dil ridge) (Fig. 2, a).

References: Domin, 1925, 1930; Deyl, 1940; Malynovski, 1980; Unar et al., 1985; Bělohlávková & Fišerová, 1989; Sanda et al., 1997; Malynovski & Kricsfalusy, 2000; Kliment et al., 2007, 2010; Šibíková et al, 2008; Ustymenko & Tasenkevich, 2009; Michl et al., 2010.

Calamagrostion arundinaceae (Luquet 1926) Oberdorfer 1957

Species-rich moderate thermophilous tall-grass communities in relatively warm and dry habitats in upper montane and subalpine belts.

Syn.: *Calamagrostion atlanticum* Luquet 1926 (art. 34a), *Calamagrostion arundinaceae* Oberdorfer 1949 (art. 8), *Calamagrostion arundinaceae* Jeník 1959 (art. 8), *Calamagrostion arundinaceae* (Luquet 1926) Jeník 1961 (art. 31).

Achilleo strictae-Calamagrostietum arundinaceae Hadač et al. 1988

Species-rich tall-grass pasturelands ("polonyna") in montane and subalpine belts (850-1200 m) on gentle, relatively warm semi-dry (southern, southeastern, and western) slopes on subacidic soils. These communities are usually dominated by *Calamagrostis arundinacea*, associated with Eastern-Carpathian and South-Eastern-Carpathian species.

Syn.: *Tanaceto-Calamagrostietum arundinaceae* Winnicki 1999, nom. inval. (art. 5).

Nomenclatural type: Hadač et al., 1988, Tab. 3, rel. 4, holotypus.

Diagnostic taxa: *Achillea stricta*, *Calamagrostis arundinacea*, *Carex umbrosa, Centaurea carpatica*, *Cruciata glabra*, *Dianthus compactus*, *Hieracium umbellatum*, *Lilium martagon*, *Pyrethrum clusii*, *Stellaria graminea*, *Thesium alpinum*, *Thymus pulegioides*, *Viola dacica* (Table 1).

Constant taxa: *Agrostis capillaris*, *Calamagrostis arundinacea*, *Cruciata glabra*, *Deschampsia cespitosa*, *Dianthus compactus*, *Festuca rubra*, *Gymnadenia conopsea*, *Hypericum maculatum*, *Luzula luzuloides*, *Potentilla erecta*, *Pyrethrum clusii*, *Scorzonera rosea*, *Stellaria graminea*, *Thymus pulegioides*, *Vaccinium myrtillus*, *V. vitis-idaea*.

Distribution in the Ukrainian Carpathians: Beskydy, Gorgany, Hryniava Mts (Fig. 2, b).

References: Hadač et al., 1988, 1995; Winnicki, 1999; Kliment, Jarolimek, 2003; Kliment et al., 2004; Stoyko et al., 2007.

Calamagrostion villosae Pawłowski et al. 1928

Medium-rich or species-poor chionophilous tall-grass subalpine vegetation.

Syn.: *Aconition firmi* Krajina 1933 (syntax. syn.), *Calamagrostion villosae* Pawłowski 1928 (art. 8), *Deschampsion caespitosae* Borza 1934 (art. 29c, 31), *Phleo alpini-Deschampsion caespitosae* (Borza 1934) Csűrös et al. 1985 (art. 29c), *Poo chaixii-Deschampsion cespitosae* Jeník et al. 1980 (art. 29c), *Trisetion fusci* Krajina 1933 (syntax. syn.).

Poo chaixii-Deschampsietum cespitosae Pawłowski et Walas 1949

Chionophilous tall-grass subalpine pastures ("polonyna") often dominated by *Deschampsia cespitosa*, on deep wet humus-rich loamy acidic allivium in depressions, snowfields, near rivers and streams in mosaic with *Pinus mugo* scrub on slightly to moderately (10-20º) steep slopes at elevations between 1300 and 1900 m. a.s.l.

Syn.: *Aconito firmi-Deschampsietum alpicolae* (Krajina 1933) Hadač in Mucina et Maglocký 1985 (art. 2b),

Deschampsietum caespitosae Krajina 1933 (art. 31), *Diantho compacti-Hypericetum maculati* Winnicki 1999, nom. invalid. (art. 5), *Gentiano asclepiadeae-Acetosum carpaticae* Hadač et al. 1988 (syntax. syn.), *Phleo alpini-Deschampsietum caespitosae* (Krajina 1933) Coldea 1983 (syntax. syn.), *Rumici-Deschampsietum caespitosae* Csűrös et al. 1985 (syntax. syn.), *Scorzonero roseae-Poetum chaixii* Hadač et al. 1995, nom. invalid. (art. 5), *Trollio altissimi-Knautietum dipsacifoliae* Winnicki 1999, nom. invalid. (art. 5), *Violo dacicae-Deschampsietum caespitosae* Rațiu et al. 1983 (syntax. syn.).

Nomenclatural type: Pawłowski et Walas, 1949: 142 – 144, Table 10, rel. 3, lectotypus (Michl et al., 2010).

Diagnostic taxa: *Cardaminopsis halleri*, *Carex ovalis*, *Cerastium fontanum*, *Crocus heuffelianus*, *Deschampsia cespitosa* (dom., opt.), *Hieracium aurantiacum*, *Omalotheca norvegica*, *Phleum alpinum*, *Poa chaixii*, *Polygonum bistorta*, *Potentilla aurea*, *Ranunculus acris*, *Trifolium repens*, *Veronica officinalis*, *Viola declinata* (Table 1).

Constant taxa: *Achillea stricta*, *Antoxanthum odoratum*, *Campanula abietina, Deschampsia cespitosa*, *Festuca picta*, *Homogyne alpina*, *Hypericum alpigenum, H. maculatum*, *Luzula luzuloides*, *Nardus stricta*, *Phleum alpinum*, *Poa chaixii*, *Potentilla aurea*, *Vaccinium myrtillus*.

Distribution in the Ukrainian Carpathians: Chornohora, Svydovets', Chyvchyny, Hryniava Mts, Marmarosh Mts, Gorgany, Beskydy (Fig. 2, c).

References: Krajina, 1933; Pawłowski & Walas, 1949; Coldea, 1983, 1991; Csűrös et al., 1985; Hadač et al., 1988, 1995; Sanda et al., 1997; Kliment et al., 2007, 2010; Michl et al., 2010.

***Hyperico alpigeni-Calamagrostietum villosae* Pawłowski & Walas 1949 nom. invers. propos.**

Relatively species rich communities dominated by *Calamagrostis villosa* on the intermediate and the upper parts of open steep slopes and depressions with deep and prolonged snow cover on well-drained siliceous bedrock with humus-poor skeletal soils in the subalpine belt (1500-1900 m).

Syn.: *Hyperico grisebachii-Calamagrostietum villosae* Pawłowski et Walas 1949 corr. Kricsfalusy et Malynovski 2000 (art. 34).

Original name form: Association à *Calamagrostis villosa* et *Hypericum alpigenum = Calamagrostidetum pocuticum* Pawł. et Wal. (Pawł 1936).

Nomen inversum propositum: according art. 10 b, 14, 42 ICPN.

Nomenclatural type: Pawłowski & Walas 1949: 140, Table 9, rel. 1, lectotypus hoc loco.

Diagnostic taxa: *Calamagrostis villosa* (dom., opt.), *Carex atrata*, *Doronicum austriacum*, *Hypericum alpigenum*, *Festuca fallax, Gentiana punctata*, *Geum montanum*, *Ligusticum mutellina*, *Phyteuma vagneri*, *Pulsatilla alba*, *Ranunculus plataniifolius*, *Soldanella hungarica, Veratrum album* (Table 1).

Constant taxa: *Calamagrostis villosa*, *Deschampsia cespitosa*, *Homogyne alpina*, *Hypericum alpigenum*, *Ligusticum mutellina*, *Luzula luzuloides*, *Potentilla aurea*, *Soldanella hungarica*, *Solidago virgaurea*, *Vaccinium myrtillus*.

Distribution in the Ukrainian Carpathians: Chyvchyny, Hryniava Mts, Marmarosh Mts, Chornohora, and western Gorgany (Fig. 2, d).

References: Pawłowski & Walas, 1949; Coldea, 1991; Sanda et al., 1997; Malynovski & Kricsfalusy, 2000.

***Vaccinio myrtilli-Calamagrostietum villosae* Sillinger 1933**

Extremely species-poor communities dominated by *Calamagrostis villosa* or *Luzula luzuloides* with relatively high cover of lichens and mosses, on cold open upper parts of slopes with very skeleton-rich shallow acid soils on flysch.

Incl.: *Calamagrostidetum villosae vaccinietosum myrtilli* Br.-Bl. 1930 (Kliment et al., 2007).

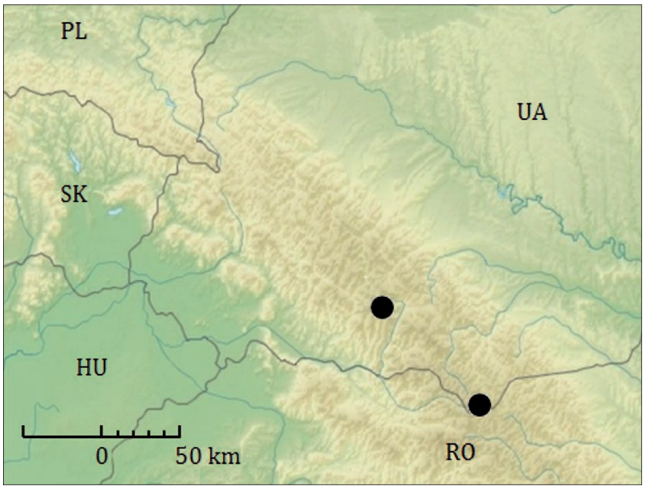
Nomenclatural type: Sillinger, 1933: 276, rel. 1, lectotypus (Kliment et al., 2004: 97).

Diagnostic taxa: *Calamagrostis villosa*, *Cladonia sp. div*., *Cetraria islandica*, *Pinus mugo*, *Vaccinium vitis-idaea* (Table 1).

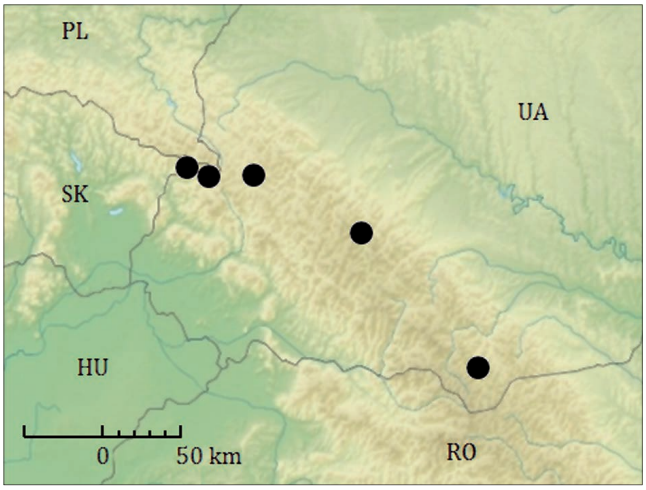
Constant taxa: *Calamagrostis villosa*, *Cladonia sp. div*, *Cetraria islandica*, *Luzula luzuloides*, *Vaccinium myrtillus*, *V. vitis-idaea*.

Distribution in the Ukrainian Carpathians: Gorgany, Chornohora (Fig. 2, e).

References: Sillinger, 1933; Kliment et al., 2004, 2007.



(a)



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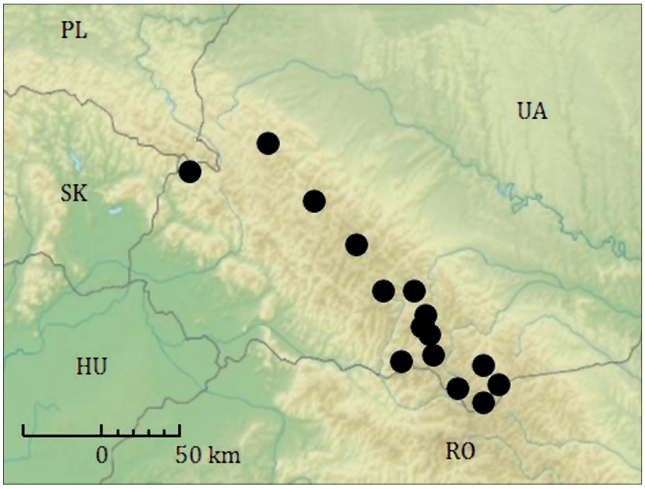

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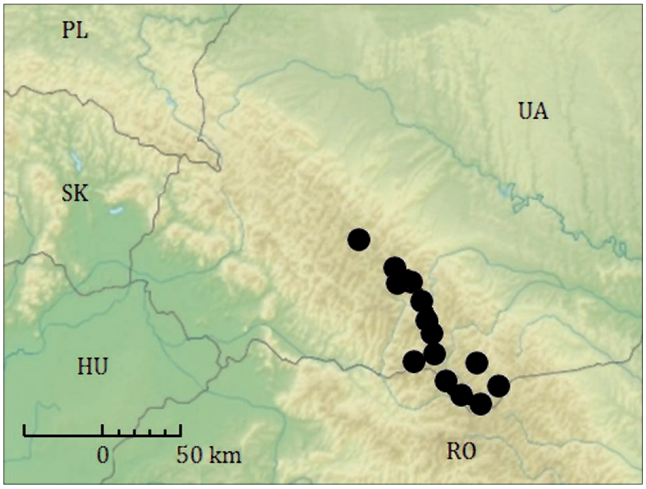

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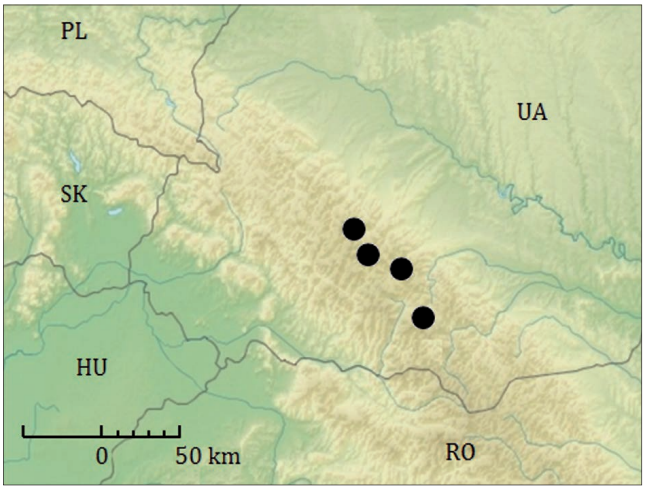

(e)

Figure 2. Geographical distribution of the associations in the Ukrainian Carpathians based on phytosociological relevés: (a) *Festucetum carpaticae,* (b) *Achilleo strictae-Calamagrostietum arundinaceae,* (c) *Poo chaixii-Deschampsietum cespitosae,* (d) *Hyperico alpigeni-Calamagrostietum villosae,* (e) *Vaccinio myrtilli-Calamagrostietum villosae.*

Table 1. Synoptic table of subalpine tall-grass communities in the Ukrainian part of the Eastern Carpathians.
The species are represented by two indicators: modified fidelity measure expressed by the Phi-coefficient and frequency expressed in percentages (FIDELITY $^{\text{frequency}}$).

Syntaxon number	**1**	**2**	**3**	**4**	**5**
Number of relevés	**13**	**32**	**36**	**50**	**18**
D.s. Ass. *Festucetum carpaticae*, Al. *Festucion carpaticae*					
Festuca carpatica	91.4 92	---·	---·	--- 6	---·
Cirsium erisithales	77.0 77	--- 12	---·	---·	---·
Euphrasia picta	73.3 62	---·	---·	--- 2	---·
Aquilegia nigricans	69.5 54	---·	---·	---·	---·
Ranunculus oreophilus	60.1 46	---·	---·	--- 4	---·
Listera ovata	59.8 54	--- 12	---·	---·	---·
Scabiosa columbaria	59.2 46	--- 3	---·	--- 2	---·
Primula elatior	50.8 62	--- 19	--- 8	--- 14	---·
Galium anisophyllon	48.1 31	---·	--- 3	---·	---·
Heracleum sphondylium	44.6 31	--- 6	---·	---·	---·
Cortusa matthioli	35.6 15	---·	---·	---·	---·
Bupleurum longifolium	30.9 15	--- 3	---·	---·	---·
D.s. Ass. *Achilleo strictae-Calamagrostietum arundinaceae*					
Thymus pulegioides	---·	92.1 88	---·	---·	---·
Pyrethrum clusii Fisch. ex Rchb.	---·	83.3 78	---·	--- 4	---·
Dianthus compactus Kit.	---·	81.4 78	--- 3	--- 4	---·
Stellaria graminea	---·	72.0 69	--- 11	---·	---·
Centaurea carpatica (Porcius) Porcius	---·	61.8 47	--- 3	---·	---·
Viola dacica	---·	59.5 41	---·	---·	---·
Thesium alpinum	---·	56.9 38	---·	---·	---·
Hieracium umbellatum	---·	48.2 41	---·	--- 2	--- 11
Lilium martagon	---·	44.6 31	--- 3	--- 4	---·
Achillea stricta	6.7 54	43.6 91	14.0 61	--- 30	---·
Carex umbrosa	---·	39.5 19	---·	---·	---·
D.s. Ass. *Phleo alpini-Deschampsietum cespitosae*					
Phleum alpinum	---·	--- 6	64.1 72	4.3 24	---·
Carex ovalis	---·	---·	62.7 47	--- 2	---·
Poa chaixii	---·	--- 19	61.7 81	6.5 32	---·
Polygonum bistorta	---·	--- 12	60.8 58	--- 4	---·
Ranunculus acris	---·	--- 3	59.1 50	--- 6	---·
Omalotheca norvegica	---·	---·	54.4 50	4.1 16	---·
Cerastium fontanum	--- 8	--- 3	53.7 53	--- 10	---·
Crocus heuffelianus	---·	--- 9	49.0 42	--- 4	---·
Veronica officinalis	---·	--- 3	47.5 31	---·	---·
Cardaminopsis halleri	---·	--- 3	31.5 19	--- 4	---·
D.s. Ass. *Hyperico alpigeni-Calamagrostietum villosae*					
Gentiana punctata	---·	---·	--- 3	62.9 54	--- 6
Geum montanum	---·	---·	--- 8	49.5 38	---·
Carex atrata	---·	---·	---·	31.4 12	---·
Festuca fallax Thuill.	---·	---·	---·	31.4 12	---·
D.s. Ass. *Vaccinio myrtilli-Calamagrostietum villosae*					
Cladonia sp.div.	---·	---·	--- 3	--- 4	77.3 72
Cetraria islandica	---·	---·	--- 6	--- 10	67.7 67
Pinus mugo	---·	---·	--- 3	--- 12	50.4 44
D.s. Al. *Calamagrostion arundinaceae*					
Cruciata glabra	25.4 54	61.9 88	--- 11	---·	---·
Calamagrostis arundinacea	--- 8	64.2 91	--- 22	--- 24	--- 11
Silene vulgaris	---·	47.3 59	--- 6	16.1 34	--- 6
Knautia dipsacifolia	7.6 23	47.3 53	--- 8	--- 2	---·
Ranunculus polyanthemos	---·	40.5 31	--- 6	--- 6	---·
Anemone nemorosa	---·	35.2 47	25.1 39	--- 10	---·
Betonica officinalis L.	---·	32.0 12	---·	---·	---·
Phyteuma spicatum	---·	32.0 12	---·	---·	---·
Avenula pubescens	---·	24.8 12	--- 3	--- 2	---·
D.s. Al. *Calamagrostion villosae*					
Hypericum alpigenum Kit.	--- 15	---·	33.2 61	49.4 76	---·
Potentilla aurea	--- 15	--- 12	56.0 89	25.8 60	---·
Festuca picta	---·	--- 3	57.2 78	30.4 54	---·
Campanula abietina Griseb.	---·	--- 3	53.2 69	21.0 42	--- 6
Soldanella hungarica	--- 8	---·	32.7 56	49.0 70	---·
Phyteuma vagneri	---·	--- 3	20.0 31	41.1 46	---·
Luzula sylvatica	---·	---·	22.8 31	39.0 42	---·
Leontodon croceus	--- 8	---·	11.0 17	26.5 26	---·
Senecio subalpinus	---·	--- 6	29.1 25	6.0 12	---·
Crepis conyzifolia	---·	---·	14.3 8	13.3 8	---·
Avenula planiculmis	---·	---·	16.6 6	2.0 2	---·
D.s. O. *Calamagrostietalia villosae*					
Luzula luzuloides	--- 31	23.7 91	6.9 75	12.3 80	--- 67
Deschampsia cespitosa	--- 8	21.5 69	52.8 100	12.7 60	---·
Ligusticum mutellina	--- 15	---·	6.8 31	54.8 72	--- 6
Calamagrostis villosa	15.0 69	---·	--- 19	39.8 94	34.7 89
Laserpitium alpinum Waldst. & Kit.	23.6 38	--- 6	--- 11	7.9 26	--- 17
Centaurea mollis	36.6 23	--- 6	---·	---·	---·
Campanula serrata	34.8 54	37.6 56	--- 8	--- 2	---·
Gentiana asclepiadea	--- 8	36.5 53	2.9 25	--- 16	--- 11
D.s. Al. *Adenostylion alliariae*					
Doronicum austriacum	---·	--- 3	--- 3	56.7 44	---·
Adenostyles alliariae	---·	---·	---·	48.7 28	---·
Cirsium waldsteinii	---·	--- 3	---·	36.6 20	---·
Cicerbita alpina	---·	---·	---·	31.4 12	---·
D.s. Cl. *Mulgedio-Aconitetea*					
Geranium alpestre	10.6 23	--- 3	13.2 25	14.6 26	---·
Pedicularis hacquetii	5.8 8	--- 3	--- 3	15.6 12	---·
Astrantia major	51.9 69	25.9 47	--- 3	--- 4	---·
Polygonatum verticillatum	13.5 15	19.7 19	---·	--- 6	---·
Chaerophyllum hirsutum	--- 8	8.3 12	10.8 14	--- 6	---·
Myosotis caespitosa Schultz	---·	1.3 6	17.9 14	5.1 8	---·
Rumex alpinus	---·	--- 3	39.1 22	---·	---·
Leucanthemum waldsteinii	--- 23	26.7 91	--- 25	2.1 26	---·
Athyrium distentifolium	---·	6.9 16	--- 3	42.2 38	---·
Rumex alpestris	---·	--- 16	25.1 44	38.8 56	---·
Veratrum album	---·	--- 12	--- 11	51.8 56	--- 6
Ranunculus platanifolius	---·	---·	---·	42.9 22	---·
Viola biflora	--- 8	---·	--- 3	38.1 28	---·
Stellaria nemorum	---·	---·	1.0 6	33.8 20	---·
Alnus viridis	---·	---·	--- 3	32.2 16	---·
Senecio fuchsii C.C.Gmel	---·	---·	15.3 19	26.1 26	--- 6
Pulmonaria filarszkyana	---·	---·	2.1 3	20.1 8	---·
Silene dioica	---·	--- 3	8.6 8	17.3 12	---·
Thalictrum aquilegiifolium	---·	3.1 3	---·	19.6 8	---·
D.s. Al. *Calamagrostion variae*					
Epipactis atrorubens	35.6 15	---·	---·	---·	---·
Acinos baumgartenii	25.0 8	---·	---·	---·	---·
D.s. Cl. *Elyno-Seslerietea*					
Thymus pulcherrimus	61.2 46	---·	--- 3	---·	---·
Festuca amethystina	44.0 23	---·	---·	---·	---·
Allium senescens	44.0 23	---·	---·	---·	---·
Gentianopsis ciliata (L.) Ma	35.6 15	---·	---·	---·	---·

segue →
← segue

Syntaxon number	1	2	3	4	5
Number of relevés	13	32	36	50	18
Galium suberectum Klokov	35.6 [15]	--- ·	--- ·	--- ·	--- ·
Linum extraaxillare Kit.	35.6 [15]	--- ·	--- ·	--- ·	--- ·
Gentiana laciniata	35.6 [15]	--- ·	--- ·	--- ·	--- ·
Astragalus krajinae Domin	25.0 [8]	--- ·	--- ·	--- ·	--- ·
Anemone narcissiflora L.	25.0 [8]	--- ·	--- ·	--- ·	--- ·
Aster alpinus	25.0 [8]	--- ·	--- ·	--- ·	--- ·
Anthyllis vulneraria	25.0 [8]	--- ·	--- ·	--- ·	--- ·
Phyteuma orbiculare	24.6 [15]	--- ·	--- [3]	2.7 [6]	--- ·
Poa rehmannii	20.9 [8]	--- ·	--- ·	--- [2]	--- ·
Carex sempervirens	16.0 [23]	--- ·	10.5 [19]	11.3 [20]	--- ·
Sesleria bielzii	15.2 [8]	--- ·	--- ·	10.0 [6]	--- ·
Carduus kerneri	8.1 [8]	--- [3]	16.4 [11]	--- ·	--- ·
D.s. Cl. *Asplenietea*					
Veronica urticifolia	54.6 [38]	--- [3]	--- ·	--- ·	--- ·
Valeriana tripteris	38.1 [38]	--- ·	--- ·	19.6 [26]	--- ·
Silene dubia Herbich	30.9 [15]	--- [3]	--- ·	--- ·	--- ·
D.s. *Cl. Thlaspietea*					
Saxifraga paniculata Mill.	51.2 [31]	--- ·	--- ·	--- ·	--- ·
Rumex scutatus	35.6 [15]	--- ·	--- ·	--- ·	--- ·
Rhodiola rosea	20.2 [15]	--- ·	--- ·	17.3 [14]	--- ·
D.s. Al. *Cynosurion*, Cl. *Molinio-Arrhenatheretea*					
Lotus corniculatus	49.4 [46]	8.6 [19]	--- ·	--- ·	--- ·
Trifolium pratense	15.7 [15]	10.1 [12]	2.1 [8]	--- ·	--- ·
Briza media	--- [8]	43.8 [31]	--- ·	--- ·	--- ·
Centaurea jacea	--- ·	42.8 [22]	--- ·	--- ·	--- ·
Dactylis glomerata	--- ·	36.0 [22]	--- [6]	--- ·	--- ·
Polygala vulgaris	--- ·	35.9 [16]	--- ·	--- ·	--- ·
Rhinanthus minor	--- ·	32.0 [12]	--- ·	--- ·	--- ·
Festuca pratensis	--- ·	32.0 [12]	--- ·	--- ·	--- ·
Lathyrus pratensis	--- ·	31.4 [22]	3.9 [8]	--- [2]	--- ·
Carex pallescens	--- ·	30.5 [28]	15.9 [19]	--- [2]	--- ·
Prunella vulgaris	--- [8]	28.7 [25]	4.2 [11]	--- ·	--- ·
Campanula patula	--- ·	18.6 [12]	--- [3]	7.9 [8]	--- ·
Rumex acetosa	--- ·	16.7 [6]	3.7 [3]	--- ·	--- ·
Leontodon autumnalis	--- ·	5.3 [3]	14.6 [6]	--- ·	--- ·
Alopecurus pratensis	--- ·	5.3 [3]	14.6 [6]	--- ·	--- ·
Trifolium repens	--- [8]	--- [9]	46.5 [42]	--- ·	--- ·
Anthoxanthum odoratum	--- ·	--- [25]	36.7 [69]	22.6 [56]	--- [22]
Poa pratensis	--- ·	--- ·	30.2 [11]	--- ·	--- ·
Vicia sepium	--- ·	--- [3]	26.4 [14]	--- [2]	--- ·
D.s. Al. *Nardo-Agrostion*, Cl. *Calluno-Ulicetea*					
Hypochoeris uniflora	--- ·	50.3 [66]	--- [17]	5.7 [28]	--- [6]
Potentilla erecta	--- [8]	56.2 [75]	14.9 [39]	--- [2]	--- [6]
Scorzonera rosea Waldst. & Kit.	--- ·	47.6 [72]	17.3 [44]	--- [22]	--- [6]
Agrostis capillaris	--- ·	42.8 [56]	35.1 [50]	--- ·	--- ·
Nardus stricta	--- ·	25.3 [41]	40.4 [53]	--- [8]	--- ·
Viola declinata	--- ·	11.9 [25]	45.9 [50]	--- [6]	--- ·
Hieracium aurantiacum	--- ·	1.0 [16]	53.2 [53]	--- [6]	--- ·
Luzula multiflora	--- ·	4.7 [12]	35.2 [31]	--- ·	--- [6]
Arnica montana	--- [15]	7.2 [28]	10.1 [31]	--- [20]	--- [17]
Carex pilulifera	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
D.s. Cl. *Caricetea curvulae*					
Avenula versicolor	10.6 [8]	--- ·	--- [3]	11.4 [8]	--- ·
Festuca airoides	7.0 [8]	--- ·	21.6 [14]	--- [2]	--- ·
Homogyne alpina	--- [15]	--- [50]	25.7 [78]	31.9 [84]	--- [33]
Juncus trifidus	--- ·	--- ·	--- ·	42.9 [22]	--- ·
Pulsatilla alba	--- ·	--- ·	--- ·	40.8 [20]	--- ·
Hieracium alpinum	--- ·	--- ·	--- [6]	36.8 [38]	13.4 [22] ↑
Huperzia selago	--- ·	--- ·	--- ·	14.4 [10]	17.1 [11] ↑ segue

Syntaxon number	1	2	3	4	5
Number of relevés	13	32	36	50	18
Other species					
Vaccinium vitis-idaea	--- [46]	20.1 [69]	--- [19]	--- [20]	40.3 [89]
Vaccinium myrtillus	--- [15]	3.6 [72]	7.0 [75]	18.8 [86]	27.9 [94]
Solidago virgaurea	--- [15]	5.0 [47]	--- [33]	22.4 [64]	8.2 [50]
Polytrichum sp.	--- ·	--- ·	44.7 [72]	7.6 [38]	14.6 [44]
Pleurozium schreberi	--- ·	--- ·	42.4 [50]	--- [16]	6.0 [22]
Linum catharticum	57.7 [38]	--- ·	--- ·	--- ·	--- ·
Rhinanthus alpinus	49.3 [38]	--- [3]	--- ·	--- [6]	--- ·
Parnassia palustris	48.8 [54]	--- [12]	--- [11]	--- [8]	--- ·
Trifolium alpestre	47.7 [31]	--- [3]	--- ·	--- ·	--- ·
Euphorbia carniolica	41.3 [46]	--- [16]	--- [14]	--- [4]	--- ·
Fragaria vesca	40.4 [23]	--- ·	--- [3]	--- ·	--- ·
Alchemilla monticola	39.6 [46]	7.0 [22]	--- [11]	--- [4]	--- ·
Gentianella lutescens	32.5 [15]	--- ·	--- ·	--- [2]	--- ·
Phyteuma tetramerum	30.9 [15]	--- [3]	--- ·	--- ·	--- ·
Centaurea maramarosiensis	30.9 [15]	--- [3]	--- ·	--- ·	--- ·
Salix silesiaca	15.2 [23]	--- [6]	--- [3]	--- [10]	14.0 [22]
Picea abies	5.5 [31]	--- [16]	--- [25]	--- [14]	21.1 [44]
Juniperus sibirica Burgsd.	4.1 [23]	--- [3]	6.5 [25]	--- [20]	10.0 [28]
Melampyrum saxosum	48.0 [54]	18.2 [31]	--- ·	--- [2]	--- ·
Gymnadenia conopsea	35.8 [62]	50.6 [75]	--- [3]	--- [6]	--- ·
Carlina acaulis	11.4 [23]	44.8 [47]	--- [3]	--- [2]	--- ·
Vaccinium uliginosum	1.9 [8]	11.5 [12]	--- [6]	2.5 [8]	--- ·
Galium verum	13.9 [15]	8.6 [12]	--- [6]	--- [6]	--- ·
Campanula glomerata	30.5 [38]	24.9 [34]	--- [6]	--- [2]	--- ·
Trollius europaeus	24.7 [31]	25.4 [31]	--- [3]	--- [4]	--- ·
Filipendula ulmaria	4.9 [8]	8.6 [9]	6.3 [8]	--- [2]	--- ·
Maianthemum bifolium	33.7 [23]	5.9 [9]	--- ·	--- ·	--- ·
Stachys alpina	20.7 [15]	7.8 [9]	--- ·	--- [4]	--- ·
Mercurialis perennis	19.0 [8]	3.3 [3]	--- ·	--- ·	--- ·
Galium schultesii	16.2 [8]	1.8 [3]	--- ·	--- [2]	--- ·
Ajuga reptans	14.9 [8]	10.5 [6]	--- ·	--- ·	--- ·
Gentianella amarella	14.9 [8]	10.5 [6]	--- ·	--- ·	--- ·
Betula pendula	16.2 [8]	1.8 [3]	--- ·	--- [2]	--- ·
Aposeris foetida	19.6 [31]	--- [12]	26.9 [36]	--- [2]	--- ·
Antennaria dioica	10.7 [8]	--- [3]	5.0 [6]	--- [2]	--- ·
Paris quadrifolia	17.7 [8]	--- ·	--- ·	5.5 [4]	--- ·
Euphrasia tatrae Wettst.	15.2 [8]	--- ·	--- ·	10.0 [6]	--- ·
Heracleum carpaticum	13.8 [15]	--- ·	--- [8]	14.9 [16]	--- ·
Festuca versicolor	26.6 [15]	--- ·	--- [3]	--- [4]	--- ·
Rosa pendulina	32.5 [15]	--- ·	--- ·	--- [2]	--- ·
Galium mollugo	20.9 [8]	--- ·	--- ·	--- [2]	--- ·
Carex ornithopoda	20.9 [8]	--- ·	--- ·	--- [2]	--- ·
Luzula sudetica	44.0 [23]	--- ·	--- ·	--- ·	--- ·
Thymus alpestris	18.5 [38]	--- [6]	32.2 [50]	--- [20]	--- ·
Brachythecium sp.	8.5 [8]	--- ·	3.2 [6]	9.3 [8]	--- ·
Hypericum maculatum	--- [8]	45.3 [78]	33.3 [67]	--- [22]	--- ·
Festuca rubra	--- [8]	43.4 [62]	22.6 [44]	--- [10]	--- ·
Veronica chamaedrys	--- ·	30.5 [31]	20.8 [25]	--- [2]	--- ·
Stellaria holostea	--- ·	5.7 [6]	25.1 [14]	--- ·	--- ·
Festuca porcii	--- ·	2.8 [3]	20.2 [8]	--- ·	--- ·
Scilla bifolia	--- ·	2.8 [3]	20.2 [8]	--- ·	--- ·
Glechoma hirsuta	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
Geum rivale	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
Festuca saxatilis Schur	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
Geranium phaeum	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
Verbascum lanatum	--- ·	9.0 [3]	7.4 [3]	--- ·	--- ·
Deschampsia flexuosa	--- ·	5.1 [16]	23.6 [28]	8.7 [18]	--- ·
Senecio papposus	--- ·	4.1 [3]	2.9 [3]	7.2 [4]	--- ·
Galeopsis speciosa	--- ·	1.9 [3]	9.6 [6]	4.7 [4]	--- ·
Sedum carpaticum G. Reuss	--- ·	18.2 [9]	--- ·	8.5 [6]	--- ·
Poa nemoralis	--- ·	7.2 [3]	--- ·	10.9 [4]	--- ·
Angelica sylvestris	--- ·	35.9 [16]	--- ·	--- ·	--- ·
Pimpinella saxifraga	--- ·	32.0 [12]	--- ·	--- ·	--- ·
Succisa pratensis	--- ·	27.4 [12]	--- [3]	--- ·	--- ·
Traunsteinera globosa	--- ·	28.6 [12]	--- ·	--- [2]	--- ·
Trisetum fuscum	--- ·	7.2 [3]	--- ·	10.9 [4]	--- ·
Chaerophyllum aromaticum	--- ·	7.2 [3]	--- ·	10.9 [4]	--- ·
Omalotheca sylvatica	--- ·	5.3 [3]	14.6 [6]	--- ·	--- ·

← antes

Syntaxon number	**1**	**2**	**3**	**4**	**5**
Number of relevés	**13**	**32**	**36**	**50**	**18**
Ranunculus repens	---·	---·	22.0 [8]	--- [2]	---·
Campanula cervicaria	---·	---·	16.6 [6]	2.0 [2]	---·
Hylocomium sp.	--- [8]	---·	14.3 [19]	24.9 [26]	---·
Oxalis acetosella	---·	---·	19.2 [17]	21.8 [18]	---·
Urtica dioica	---·	---·	16.6 [6]	2.0 [2]	---·
Rhytidiadelphus squarrosus	---·	---·	39.0 [42]	22.4 [30]	---·
Leontodon hispidus	---·	--- [6]	37.8 [33]	2.8 [12]	---·
Pogonatum alpinum	---·	---·	10.8 [6]	12.3 [6]	---·
Phegopteris connectilis	---·	---·	6.1 [3]	11.4 [4]	---·
Mnium sp.	---·	---·	4.2 [6]	26.0 [14]	---·
Caltha laeta Schott, Nyman & Kotschy	---·	---·	9.4 [3]	5.4 [2]	---·
Cardamine pratensis	---·	---·	9.4 [3]	5.4 [2]	---·
Hieracium prenanthoides	---·	---·	9.4 [3]	5.4 [2]	---·
Rubus idaeus	---·	---·	5.6 [6]	23.1 [12]	---·
Coeloglossum viride	---·	---·	3.9 [3]	16.2 [6]	---·
Crepis paludosa	---·	---·	9.4 [3]	5.4 [2]	---·
Carex sylvatica	---·	---·	9.4 [3]	5.4 [2]	---·
Epilobium angustifolium	---·	--- [3]	--- [6]	28.2 [18]	---·
Rhododendron kotschyi	---·	---·	---·	44.9 [24]	---·
Campanula rotundifolia	--- [8]	---·	--- [6]	33.7 [26]	---·
Myosotis alpestris	---·	---·	--- [3]	32.2 [16]	---·
Rhytidiadelphus triquetrus	---·	---·	--- [6]	36.1 [22]	---·
Sphagnum sp.	---·	---·	4.5 [6]	10.9 [8]	4.5 [6]
Melampyrum herbichii	---·	--- [9]	--- [8]	3.8 [16]	29.2 [33]
Sorbus aucuparia	---·	---·	---·	3.5 [6]	29.2 [17]
Dicranum sp.	---·	---·	--- [6]	--- [6]	30.8 [22]

Taxa with low frequency occuring in one association only:

1: *Abies alba*, *Spiraea chamaedryfolia* (35.6 [15]); *Asplenium viride*, *Agrostis rupestris*, *Cerastium lanatum* Lam., *Daphne mezereum*, *Epipactis helleborine*, *Hieracium villosum* (25.0 [8]).

2: *Allium victorialis*, *Phleum pratense*, *Plantago lanceolata*, *Thalictrum minus* (27.6 [9]); *Botrychium lunaria*, *Brachypodium pinnatum*, *Centaurea kotschyana*, *Dianthus deltoides*, *Digitalis grandiflora*, *Euphrasia rostkoviana*, *Gymnadenia odoratissima*, *Knautia arvensis*, *Trifolium medium*, *T. montanum* (22.5 [6]); *Aconitum lasiocarpum* Gayer, *A. moldavicum* Hacq., *Aegopodium podagraria*, *Athyrium filix-femina*, *Campanula persicifolia*, *Carex brizoides*, *C. hirta*, *Chamaespartium saggitale*, *Cirsium oleraceum*, *Cynosurus cristatus*, *Dactylorhiza sambucina*, *Dianthus carthusianorum*, *Empetrum hermaphroditum* Hagerup, *Euphrasia stricta*, *Festuca apennina* De Not., *Genista tinctoria*, *Holcus mollis*, *Lathyrus sylvestris*, *Lysimachia vulgaris*, *Orchis mascula subsp.signifera*, *Origanum vulgare*, *Picris hieracioides*, *Pimpinella major*, *Polygala comosa*, *Scrophularia scopolii*, *Danthonia decumbens*, *Soldanella montana*, *Tragopogon pratensis*, *Vicia cracca*, *Viola riviniana* (15.9 [3]).

3: *Rumex acetosella* (33.8 [14]); *Euphorbia amygdaloides* (26.0 [8]); *Hieracium pilosella*, *Pseudorchis albida*, *Luzula campestris*, *Poa alpina*, *Taraxacum officinale*, *Veronica serpyllifolia* (21.2 [6]); *Achillea cartilaginea*, *Cardamine flexuosa*, *Carex nigra*, *Diphasiastrum alpinum*, *Juncus effusus*, *Lychnis flos-cuculi*, *Lycopodium clavatum*, *Pedicularis verticillata*, *Silene pusilla*, *Symphytum cordatum* (14.9 [3]).

4: *Hieracium* sp. (33.9 [14]); *Aconitum nanum* (Baumg.) Simonk., *Luzula alpinopilosa*, *Milium effusum*, *Ranunculus carpaticus* (28.6 [10]); *Campanula alpina*, *Empetrum nigrum*, *Hieracium atratum*, *Poa deylii* Chrtek & V.Jirásek, *Rumex obtusifolius*, *Valeriana sambucifolia* J.C.Mikan (22.0 [6]); *Dryopteris dilatata*, *Pedicularis sylvatica*, *Veronica baumgartenii* (25.5 [8]); *Aconitum variegatum*, *Bartsia alpina*, *Chrysosplenium alpinum*, *Eurynchium piliferum*, *Lamiastrum galeobdolon*, *Pohlia nutans* (18.0 [4]); *Achillea lingulata*, *Adoxa moschatellina*, *Allium ursinum*, *Angelica archangelica*, *Atrichum* sp., *Bryum* sp., *Chrysosplenium alternifolium*, *Clematis alpina*, *Cystopteris sudetica*, *Dentaria glandulosa* Waldst. & Kit., *Dryopteris filix-mas*, *D. carthusiana*, *Epilobium montanum*, *Euphrasia salisburgensis*, *Gentiana acaulis*, *Hieracium grandidens*, *H. nigrescens*, *Lloydia serotina*, *Potentilla reptans*, *Ribes alpinum*, *Rhinanthus angustifolius* (12.7 [2]).

5: *Pinus cembra* (21.2 [6]).

Syntaxon numbers:

1 – *Festucetum carpaticae*, 2 – *Achilleo strictae-Calamagrostietum arundinaceae,* 3 – *Poo chaixii-Deschampsietum cespitosae,* 4 – *Hypérico alpigeni-Calamagrostietum villosae,* 5 – *Vaccinio myrtilli-Calamagrostietum villosae.*

Sources of the relevés:

1: Malynovski & Kricsfalusy, 2000, P. 93, Table 20, rel. 8-12 (5 rel.), Chornei I. & Tokaryuk A., 2009, unpubl. (8 rel.);

2: Hadač et al., 1995, P. 687 (1 rel.), Kvakovska I., 2009, unpubl. (21 rel.), Tokaryuk A., 2009, unpubl. (5 rel.), Burlaka M., 2008., unpubl. (5 rel.);

3: Pawłowski & Walas, 1949, Table X, rel. 1-16 (16 rel.), Malynovski & Kricsfalusy, 2000, P. 160, Table 44, rel. 1-11 (11 rel.), Malynovski & Kricsfalusy, 2000, P. 163, Table 45, rel. 1-8 (8 rel.), Solomakha et al., 2004, P. 79, Table 3.15, rel. 4 (1 rel.);

4: Pawłowski & Walas, 1949, Table IX, rel. 1-20 (20 rel.), Malynovski & Kricsfalusy, 2000, P. 156, Table 43, rel. 1-15 (15 rel.), Burlaka M., 2008, unpubl. (10 rel.), Iakushenko D., 2008, unpubl. (5 rel.);

5: Burlaka M., 2008, unpubl. (13 rel.), Iakushenko D., 2007, unpubl. (5 rel.).

DISCUSSION

The results show clear differences between the five groups of subalpine tall-grass communities (Table 1). However, their positions within the order *Calamagrostietalia villosae* remain still rather uncertain.

The syntaxonomical distinctiveness of the alliance *Festucion carpaticae* is questioned by some authors. In the most recent survey, Michl et al. (2010) merged this alliance with *Calamagrostion villosae*. An intermediate position of this syntaxon between subalpine tall-grass vegetation dominated by *Calamagrostis arundinacea* or *C. villosa* and calciphilous communities belonging to the class *Elyno-Sesslerietea* Br.-Bl. 1948 was repeatedly mentioned (Kliment et al., 2004; Kliment & Valachovič, 2007). In the data analyzed in our work, relevés of the association *Festucetum carpaticae* contain a lot of species of the class *Elyno-Sesslerietea*; some

of them attain high fidelity values (*Thymus pulcherrimus, Festuca amethystina, Allium montanum, Gallium suberectum, Gentiana laciniata, Linum extraaxillare* etc) (Table 1). Moreover, some relevés classified as representatives of *Thymo-Festucetum amethystinae festucetosum carpaticae* Kricsfalusy et Malynovski 2000 within the class *Elyno-Seslerietea* (Malinovski & Kricsfalusy, 2000: 93-101), have been included by us into *Festucetum carpaticae*. We consider the alliance *Festucion carpaticae* as a separate unit because of its significant floristic and ecological peculiarity within the order *Calamagrostietalia villosae*.

The association *Festucetum carpaticae* is reported for Ukraine for the first time by Domin (1930) from Svydovets'. The corresponding relevés were cited by Bělohlávková, Fišerová (1989: 4, Table 1, rel. 11, only data of the taxa presence without semi quantitative values) as "not typical *Festucetum carpaticae*" (Ibid.: 22). The association was not mentioned in later surveys (Malynovski & Kricsfalusy, 2000; Solomakha, 2008); only Malynovski (2003) mentions this syntaxon without references or relevés.

Quite interesting are the syntaxonomical positions of species-rich montane to subalpine communities dominated by *Calamagrostis arundinacea*, reported for Beskydy, but known also from Chyvchyny, Marmarosh, Gorgany and Chornohora Mts (Malynovski, 1980). Available relevés belongs to only one association *Achilleo strictae-Calamagrostietum arundinaceae* Hadač et al. 1988, described from the southern slopes of the westernmost part of the Eastern Carpathians (Hadač et al., 1988). The association *Tanaceto-Calamagrostietum arundinaceae* Winnicki 1999 invalidly described from the northern slopes of the same mountain ridge (Winnicki, 1999) does not show any significant differences from the previous one and seems to be just a synonym. Considering the relatively large species pool of the Eastern Carpathians (Czopik, 1976; Tasenkevich, 2006; Chornei, 2009), the local heterogeneity of bedrocks and the peculiarities of the land-use history, we expect a higher diversity within the alliance *Calamagrostion arundinaceae* at the association or subassociation level, especially in the Marmarosh and Chyvchyny regions (cf. Kliment et al., 2007). More detailed studies both in the Romanian and the Ukrainian parts of the region should help to solve this problem within the alliance.

Regarding *Achillea stricta*, although this species exhibits a high fidelity in communities of the association *Achilleo strictae-Calamagrostietum arundinaceae*, it probably should also be treated as a regionally diagnostic species for the order *Calamagrostietalia villosae* in the Eastern Carpathians, because of its rather high constancy in other communities. Moreover *Dianthus compactus*, *Centaurea carpatica*, and *Viola dacica* clearly reflect the East Carpathian nature of this association.

The secondary origin of these communities, formed under the influence of extensive grazing (Malynovski, 1980, 2003) is clearly seen in the considerable proportion of mesophilous meadow species associated with the "polonyna" pastures of the alliance *Cynosurion cristati* Tx. 194 (*Briza media, Centaurea jacea, Dactylis glomerata, Polygala vulgaris*, etc.), suballiance *Polygalo-Cynosurenion* Jurko 1974 (*Carlina acaulis*, *Campamula glomerata*, *Gymnadenia conopsea*, etc.), and the alliance *Nardo-Agrostion tenuis* Sillinger 1933 (*Hypochoeris uniflora*, *Scorzonera rosea*, *Agrostis capillaris*, etc.) (Table 1).

The association *Bupleuro-Calamagrostietum arundinacea* (Zlatnik 1928) Jenik 1961, is mentioned by Malynovski (2003) without any references or relevés. The occurence of this associations in the Ukrainian Carpathians seems to be quite plausible in "polonynas" of the montane belt in Transcarpathia, but this suggestion still needs confirmation.

The other communities with a significant cover of *Calamagrostis arundinacea* are mentioned for the montane belt in Gorgany and Chornohora mountains. They are regarded as belonging to the association *Calamagrostio-Spireetum chamaedrifoliea* Resmeriţă et Csűrös 1966, ranked into the alliance *Calamagrostion arundinaceae*. These communities develop on siliceous flysch on steep (30-45º) slopes, rock shelves and cracks with shallow skeletal soils (Klimuk et al., 2006; Iakushenko, 2007). Considering the dominance of shrubs species (*Lonicera xylosteum*, *Rosa pendulina, Spiraea chamaedryfolia*, etc.) we removed such relevés from the present analysis.

Mesic and wet subalpine tall-grass pastures dominated by *Deschampsia cespitosa* are very common in the Ukrainian Carpathians due to earlier disturbance. Although their distribution, dynamic and ecological peculiarities were previously studied (Iermachenko, 1962; Malynovski, 1980), their syntaxonomical position is still ambiguous and doubtful.

Two associations, namely *Poo chaixii-Deschampsietum cespitosae* and *Phleo alpini-Deschampsietum caespitosae*, are reported for the subalpine belt of the Ukrainian Carpathians (Malynovski & Kricsfalusy, 2000; Solomakha, 2008). They belong either to the alliance *Calamagrostion villosae* (Michl et al., 2010), or to the alliance *Trisetion fusci* (Kliment et al., 2010). In the analyzed dataset we found only few diagnostic species for the alliance *Trisetion fusci*. All of them, except *Cerastium fontanum*, exhibit insignificant fidelity values. Although the species *Festuca picta*, *Hypericum alpigenum*, *Campanula abietina*, *Soldanella hungarica*, *Phyteuma vagneri* seem to be diagnostic for the alliance *Calamagrostion villosae*, they are common both in *Phleo alpini-Deschampsietum* and in communities that undoubtedly belong to the *Calamagrostion villosae* (Table 1). So, following Michl et al. (2010), we consider the alliance *Trisetion fusci* as syntaxonomical synonym of the alliance *Calamagrostion villosae*.

Though the authors analyzed mainly relevés from the Sudeten Mts (Michl et al., 2010: 153), they used the name *Poo chaixii-Deschampsietum cespitosae* – the association originally described from the Eastern Carpathians within the alliance *Calamagrostion villosae* (Pawłowski & Walas, 1949). We did not found any significant differences in floristic composition between the phytosociological relevés of both associations collected in the different parts of our study area (from Czywczyny to Beskydy). Thus, we suggest that *Phleo alpini-Deschampsietum caespitosae* is a syntaxonomical synonim of the *Poo chaixii-Deschampsietum cespitosae*. In this respect we should reject the name *Phleo alpini-Deschampsietum caespitosae*.

Communities dominated by *Calamagrostis villosa* belong to two associations. As mentioned above, the original name of the association *Hyperico alpigeni-Calamagrostietum villosae* was "Association à *Calamagrostis villosa* et *Hypericum alpigenum* = *Calamagrostidetum pocuticum* Pawł. et Wal. (Pawł 1936)" (Pawłowski & Walas, 1949). As the second name should be rejected according to art. 34 ICPN, the first name should be corrected according to art. 10 b, 14 ICPN.

Currently, *Hypericum alpigenum* Kit. is considered to be the synonym of an accepted name *Hypericum richeri* Vill. subsp. *grisebachii* (Boiss.) Nyman (Tutin et al., 1968; Ciocârlan, 2009). However, since the name *Hypericum alpigenum* Kit. was validly published in 1863 (Sennikov, 1996), we believe that the association name was unreasonably (art. 34 ICPN) changed by Malynovski & Kricsfalusy (2000) on *Hyperico grisebachii-Calamagrostietum villosae* Pawł. et Wal. 1949 corr. Kricsfalusy et Malynovski 2000. *Hypericum grisebachii* Boiss is also considered to be the synonym of *Hypericum richeri* Vill. subsp. *grisebachii* (Boiss.) Nyman (Tutin et al., 1968). Consequently, the form *Hyperico grisebachii-Calamagrostietum villosae* Pawł. et Wal. 1949 used by Romanian researchers (Coldea, 1991; Sanda et al., 1997) should be also changed.

Thus, according to art. 42 we propose the following correct form of the name: *Hyperico alpigeni-Calamagrostietum villosae* Pawłowski et Walas 1949 nom. invers. propos.

The last association, *Vaccinio myrtilli-Calamagrostietum villosae*, distinguished for the Ukrainian part of the Eastern Carpathians for the first time (cf. Malynovski, Kricsfalusy, 2002). These species-poor communities with abundant cover of lichens and mosses dominated by *Calamagrostis villosa* or *Luzula luzuloides* are definitively transitional between tall-grass *Calamagrostietalia villosae* communities, on one side, and *Loiseleurio-Vaccinietea* Eggler ex Schubert 1960 and *Caricetea curvulae* Br.-Bl. 1948 communities, on the other (Table 1). Stands of this association occur mainly in the Gorgany Mts. More investigations are needed to clarify their syntaxonomical positions.

Conclusions

Subalpine tall-grass communities in the Ukrainian part of the Eastern Carpathians are represented by five associations: *Festucetum carpaticae* (species-rich chionophilous tall-grass communities on moist carbonate soils), *Achilleo strictae-Calamagrostietum arundinaceae* (species-rich moderate thermophilous tall-grass communities in relatively warm and dry habitats on flysch), *Poo chaixii-Deschampsietum cespitosae* (chionophilous tall-grass subalpine pastures dominated by *Deschampsia cespitosa* on deep wet humus-rich acidic soils), *Hyperico alpigeni-Calamagrostietum villosae* (relatively species rich communities dominated by *Calamagrostis villosa* on siliceous bedrock), and *Vaccinio myrtilli-Calamagrostietum villosae* (extremely species-poor communities on cold slopes with shallow acidic soils). The syntaxonomy of these communities can be assessed as follows:

Mulgedio-Aconitetea Hadač et Klika in Klika et Hadač 1944

Calamagrostietalia villosae Pawłowski et al. 1928.

Festucion carpaticae Bělohlávková et Fišerová 1989.

Festucetum carpaticae Domin 1925.

Calamagrostion arundinaceae (Luquet 1926) Oberd. 1957.

Achilleo strictae-Calamagrostietum arundinaceae Hadač et al. 1988.

Calamagrostion villosae Pawłowski et al. 1928.

Poo chaixii-Deschampsietum cespitosae Pawłowski et Walas 1949.

Hyperico alpigeni-Calamagrostietum villosae Pawłowski et Walas 1949 nom. invers. propos.

Vaccinio myrtilli-Calamagrostietum villosae Sillinger 1933.

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